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UNITED STATES DEPARTMENT OF AGRICULTURE

BULLETIN No. 277

Contribution from the Office of Markets and Rural Organization
CHARLES J. BRAND, Chief

Washington, D. C. ▼ August 7, 1915

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COTTON WAREHOUSE CONSTRUCTION

By

ROBERT L. NIXON, Assistant in Cotton Marketing

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By ROBERT L. NIXON,
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INTRODUCTION.

The purpose of this bulletin is to outline, in a general way, some of the essential features of a warehouse for the storage of cotton. It is a fact, not a theory, that loans on cotton in warehouses of "standard" construction can be obtained much more readily and at a lower rate of interest than on cotton stored in many of the other types of warehouses now widely used. The expense of storing cotton in an accepted type of warehouse, such as the standard, is much lower than in many of the structures now used. The present system of storing the bulk of the cotton crop in buildings which are not considered good risks by the insurance companies and the consequent high rate of insurance demanded on the cotton, together with the higher rate of interest on loans made on cotton stored in these warehouses, has resulted in a marked movement for the improvement of cotton-storage facilities. It may be used as a guide in deciding what type of warehouse to build and in making plans for the building; but neither the descriptions nor the illustrations should be used as specifications. An endeavor has been made to keep in mind the cost of construction, the arrangement necessary to minimize the cost of handling cotton, and those features which tend to reduce the insurance rate. The term "standard warehouse" does not refer to any Government standard, but to

NOTE.—This bulletin should be of special interest to warehousemen, cotton dealers, and those contemplating the construction of cotton warehouses, and of general interest to all farmers, bankers, and business men of the South.

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the standards recognized by the fire insurance underwriters' associations. "Rates, Rules, and Forms" of the Southeastern Underwriters' Association are followed in discussing these standards and the insurance rates on cotton stored in such buildings. This association has jurisdiction in Virginia, North Carolina, South Carolina, Georgia, Florida, and Alabama. The rates and standards used in Mississippi are practically the same as those used by the Southeastern Association. The standards and the rates recognized in other cotton-producing States are very nearly the same as those outlined in this publication.

While this bulletin is intended primarily to treat of the construction of cotton warehouses, it seems advisable to discuss in a general way the importance of storage houses and the principles of storage. Thorough investigations show conclusively that the present storage houses are not rendering satisfactory service. An adequate system of warehouses would bring about important economic reforms in the handling and marketing of cotton. For this reason it seems wise to discuss these subjects before describing in detail the different types of warehouses.

IMPORTANCE OF STORAGE HOUSES.

It has long been realized that the inauguration of an adequate system of warehouses would aid greatly in marketing the cotton crop. This valuable staple, with an annual value of approximately $1,000,000,000, usually is harvested and marketed in 3 or 4 months. It requires 12 months for the mills of the world to consume this supply. It is quite evident that if this cotton continues to be forced on the market within a comparatively few months in each year, as at present, the price will be depressed unduly. This not only results in a material loss to the farmer, but the various branches of the trade are taxed in the effort to handle it in such a rush. When the output of any factory is in excess of the demand, the production is curtailed or the excess of manufactured articles is stored in order to conserve them properly until there is an increased demand. This is also true in the case of some agricultural products, but unfortunately the South is not prepared to conserve, even temporarily, the excess production of cotton in a proper and economical manner. It is also true that many of the farmers and dealers suffer a great loss because they do not understand the importance of protecting and conserving cotton while it is awaiting a fair market.

This condition becomes very serious during practically every cotton-picking season. The price is depressed during October, November, and December, when it is being sold by the farmer. The price then gradually increases, but this increase is of little benefit to the farmer, for he has disposed of his holdings. There

seems to be only one way in which he can protect himself. He must prepare to hold his cotton until it is needed by the manufacturers and exporters. Then, and not until then, will he get a fair market price for the chief agricultural product of the South. In preparing to hold cotton it is very important that he should make some provision to protect it from damage by weather. It is also necessary to arrange his business affairs so that he can hold his cotton for a considerable length of time without becoming financially embarrassed.

An adequate storage system is essential for the proper handling and marketing of the cotton crop of the South, which, including the seed, is worth annually approximately $1,000,000,000. In many cases it is difficult for small merchants and growers to borrow money on cotton at 7, 8, or even 10 per cent. If it were stored in a standard warehouse belonging to a properly organized system it would unquestionably be possible for merchants to reduce this interest rate to 5 or 6 per cent and possibly to 4 or 4½ per cent. This would help greatly in financing and marketing this valuable staple.

In addition to cotton, various other articles could be stored to advantage if adequate facilities were offered. There is a great demand for storage space for fertilizers, farm implements, feedstuffs, and merchandise of various kinds. Storage facilities are needed also for various other agricultural products. There are at least $2,000,000,000 worth of farm products and merchandise that undoubtedly should be stored annually. It is remarkable that this opportunity for profitable investment of capital should be neglected. The inauguration of such a system of warehouses would give great impetus to the commercial development of this section. This subject is uppermost in the minds of the best business men, and all concur in the belief that properly equipped warehouses are a great necessity.

PRINCIPLES OF STORAGE.

Conservation is the central idea involved in warehousing. Storage is not entirely a modern business development. Some of the oldest business establishments of which we have any account were founded on the use of storage places. Ancient history gives some good illustrations of the value of conservation. The Phœnicians developed a wonderful commerce on the Mediterranean and became a rich and powerful people. Their facilities for handling and conserving wares made this great development possible. The Egyptians saved the surplus grain during years of abundant harvests, and when years of famine came they not only had plenty but sold the surplus they had saved to their neighbors at "corner" prices. Unfortunately, the American people have not been inclined to conserve their resources.

Nature has dealt so generously with them that they have not been compelled to realize the importance of saving. The South particularly has been inclined to disregard the future. The present crisis in the cotton market comes in a most unexpected manner and drives home the lesson of the importance of conservation. The grain growers of the Middle West have long realized the absolute necessity of a system of elevators for handling and storing their grain. Now the South realizes that a system of warehouses is essential for saving, handling, and marketing the cotton crop. Many are suffering because they have been too short-sighted to take the necessary precaution. Cotton lends itself more readily to storage than does any other valuable farm product. In view of this, it seems strange that storage has not been practiced. On the other hand, it is injured less by exposure than are most products. This partly accounts for the present attitude toward storage. Cotton does not demand storage; consequently it is grossly neglected.

FUNCTIONS OF A WAREHOUSE.

A warehouse has three legitimate and very important functions:

First, it offers temporary storage facilities when the person owning the product is not in a position to store it himself. In the cotton business, in normal years, this will cover the period from the time the cotton is ginned until it is sold by the farmer. It also provides the cotton dealer with a place in which to store his cotton from the time it is purchased until it is shipped.

Second, the warehouse should furnish the owner of the stored product a negotiable receipt. This receipt should show definitely what product is stored, the ownership, the amount of goods, the kind or grade, the condition, and the location of the warehouse. It should also show that the stored products are properly protected by insurance. The legal holder of such a receipt would be protected as fully as if he had the goods securely locked in his own vault.

Third, the warehouse provides a reservoir for surplus during years of overproduction or when market conditions are very unsatisfactory. When there is a surplus of any product there should be some way of saving it until there is a better demand for it.

In keeping qualities, cotton is superior to all other agricultural products. Properly stored it can be kept indefinitely without the slightest deterioration. It seems remarkable that so little advantage has been taken of this superior keeping quality. The fact that cotton can be left in the weather for several months doubtless accounts for some of the existing indifference to the subject. The South could save millions of dollars in normal years by protecting cotton from the weather. It is to be hoped that the lesson which is costing so much now will result in the saving of many times the present loss in

future years. The inauguration of an ample and efficient system of warehouses would mark the beginning of a progressive revolution in the cotton markets.

Storage not only protects cotton from the weather, but from other forms of wear and tear. In many places where cotton is sold on the street, numerous large holes are cut in the wrapping for pulling samples. Frequently the owner loses several pounds in this unnecessary process, and the bale is left in a ragged and unsightly condition. It has been rendered less resistant to fire and exposure to weather by this damage. The samples are frequently thrown on the street and become a menace on account of increasing danger from fire. Besides this, they are unsightly and destructive of civic pride.

As yet the warehouse is the most practical and economical means of holding the cotton until it is needed. A recent investigation made by this office indicated that the total storage capacity of the warehouses now in use in the South is ample for protecting a maximum crop, but the same investigation showed clearly that only a very small percentage of these storage houses were properly located or so organized as to render efficient service.[1] It is also true that most of the present buildings are poorly constructed, thereby making it necessary to pay an excessive rate of insurance, and they are so arranged that the cost of handling cotton is unreasonably high. While it is true that in total capacity the present storage houses are sufficient, the results of the investigation emphasize the fact that in point of convenience and service rendered they are entirely inadequate.

The same investigation showed that cotton, when properly stored and insured with a reputable company, is considered by the most substantial bankers the very best collateral that can be offered. Numerous companies in the South have such arrangements with bankers as will enable the owners of cotton to store it with these companies and readily obtain loans on the best possible terms. Yet a large majority of the storage houses have very little business standing; consequently it frequently is difficult or almost impossible to borrow money on cotton stored with them. It is often true that these poorly organized companies are located in the cotton-producing communities. These are the kinds of warehouses with which many farmers have been compelled to deal, and frequently they are the only kinds of which they have any knowledge. For this reason their attitude toward storing is almost hostile. They know from experience that they have to pay entirely too much for the service rendered by the companies, and they naturally have concluded that it does not pay to store cotton.

[1] Nixon, Robert L. Cotton Warehouses: Storage facilities now Available in the South. U. S. Department of Agriculture, Bulletin 216, 1915.

Notwithstanding all of the objectionable features of the storage business as now conducted, the farmer frequently considers it necessary or to his advantage to hold his cotton. The past year has been most strenuous for the cotton farmer; one of the largest crops ever produced in the United States, the growth of 1914, has left his hands. However, the world's visible supply, at the opening of the new cotton year, August 1, was in round figures about $1\frac{3}{4}$ million bales larger than a year earlier. That means a large proportion of the world's cotton crop of 1914 growth was carried over and added to this season's crop. However, the exports of cotton from this country during the cotton year closed August 1, 1915, were very close to those of the year ended August 1, 1914. This year's crop, at the time of this bulletin's going to press, is still in the making. But when it is considered that in normal years there is a loss of from $30,000,000 to $75,000,000 from what is generally, although incorrectly, called "country damage," it will be seen that there is ample need of an adequate warehousing system, regardless of whether the crop is larger or smaller than normal.

In connection with the value of a negotiable warehouse receipt, it should be said that proper State laws covering the issuance of the receipts are necessary. In order to be of greatest value the warehouse receipts should show beyond question the ownership of the product stored, and this accuracy can not be accomplished unless the States in which the warehouse companies operate have laws that properly guard the issuance of receipts. If the laws of the State in which the warehouse is located are such as to throw any cloud upon the title of the goods covered by the receipt, the receipt immediately becomes almost worthless as collateral and defeats any effort to borrow money at cheap rates from outside sources. In addition to enacting such laws as will guarantee effectively the integrity of warehouse receipts, it seems advisable for all States to adopt a law of uniform warehouse receipts. This law is now in effect in many of the States, and has been approved by the American Warehousemen's Association, the American Bankers' Association, and the American Bar Association as being the best form in which laws can be made to protect both the owner of the goods and the lender of money against the receipts covering such goods.

The investigations previously referred to showed that there has been great loss in the construction of the present warehouses. The data gathered seemed to prove that the average insurance rate on cotton in the buildings now in use is not less than $2 per annum on $100. It is also true that if the money that has been spent on these buildings had been expended economically and intelligently in the construction of standard warehouses, properly protected with automatic sprinkler equipment, the rate of insurance could be

reduced to 25 cents per $100. This would represent an enormous annual saving. Many of the inferior buildings now in use should be discarded entirely, and new warehouses, located with reference to the probable demands for storage, should be built. It would be possible also to remodel many of the poorly constructed buildings which are well located, so as to increase their efficiency and effect a great saving in the cost of insurance.

EXPLANATION OF THE TERM "STANDARD" AS APPLIED TO COTTON WAREHOUSES.

An endeavor has been made to give reliable information in regard to types of warehouses and insurance rates. A person who is preparing to build will get better results, especially in insurance rates, by following the suggestions given here, but, as previously stated, the types of warehouses described are not to be regarded as "Government standards" in any sense. They are the standards recommended by the fire insurance underwriters' associations. Buildings erected in accordance with these standards command a much lower rate of insurance than those that do not conform to them. While endeavors have been made in this bulletin to give definite information about insurance rates, no responsibility is assumed by the writer as to the correctness of the rates quoted, or the accuracy of the descriptions of the different types of storage houses. Anyone planning to build should have specifications drawn by an architect (many carpenters can make satisfactory plans) and submitted for approval to the underwriters having jurisdiction. This plan usually will save the prospective builder a great deal of money, especially in insurance rates.

TYPES OF STANDARD WAREHOUSES.

STANDARD I.—CLOSED COTTON WAREHOUSE (DETACHED), COMPARTMENTS LIMITED TO 600 BALES' CAPACITY.

The standard for the closed warehouse of two or more compartments requires that it should not be exposed by other buildings within 100 feet, and that no compartment should have a capacity exceeding 600 bales. To be most effective, this warehouse should be a low, one-story structure. In figure 1 is shown the proper size and arrangement of the compartments composing such a warehouse. The bales of cotton should be stored on end, only one bale deep, and at least one passageway with a minimum width of 4 feet should extend through the compartment the longest way, leading to a door at each end. (See fig. 12.) Such a passageway facilitates handling cotton during the transaction of ordinary business and is a necessity in properly controlling a fire.

Walls.—A blank wall of brick not less than 17 inches in thickness [1] should separate each compartment. This wall should be parapeted above the roof at least 3 feet, and the parapets should be capped with durable coping. The wall and parapet should extend 3 feet beyond the frame end walls. Division walls forming a T instead of extending beyond the frame end walls would be a desirable improvement. Outside end walls should be constructed of clapboards (weather boards) securely nailed to posts and studding, which render the wall

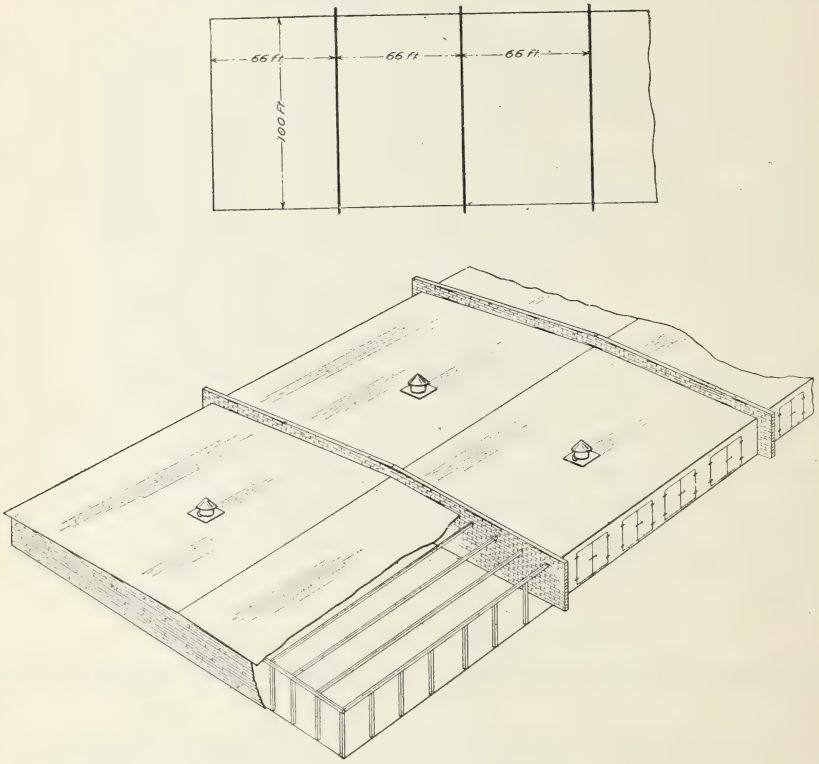


FIG. 1.—Closed cotton warehouse, compartments limited to 600 bales capacity—detached.

spark proof and weatherproof. All woodwork exposed to the weather should be painted or whitewashed. When the end of the warehouse, which is formed by the outer side walls of the end compartments, is exposed, this wall should be of brick at least 13 inches thick and coped in the same manner as the division walls.

Floors.—Floors should be preferably of concrete, but may be of earth, brick, or some other incombustible material. (See discussion of floors on p. 32.) When the floor is elevated to the height of the car floor, with frame platforms extending across the ends of the compartments, the division walls should be built from the ground to the

[1] The thickness of walls referred to in all of the standards are for one-story buildings. For thickness required in buildings of greater height, see table on p. 32.

height of the platform and should extend through these platforms so as to cut them off into divisions corresponding to the compartments in the warehouse.

Roof.—The roof should be of light mill construction, with a minimum thickness of 2 inches splined or tongued and grooved, supported by timbers single thick (not less than 6 by 8 inches) and spaced 8 or 10 feet apart. One end of the timber should rest on brick ledges or division walls, corbeled out to form suitable supports. The posts should be not less than 8 by 8 inches, and all corners of timbers and posts should be chamfered. Monitors, skylights, and roof lanterns should not be allowed unless they are made of wired glass, properly set in metal frames. The roof should be covered with gravel or approved composition. A roof of ordinary open-joist construction covered with gravel or approved composition will be classed as standard, but if automatic sprinklers are to be installed, it will be necessary to have from 25 to 50 per cent more heads than are necessary in the case of a roof of mill construction.

Samples.—All standards should require that the cotton be graded, and all books showing the number of bales, weights, and marks should be kept in some locality a sufficient distance from the warehouse or in a separate fireproof compartment or vault, so as not to be damaged by fire. Such books and samples also should be kept in a fireproof compartment or vault.

Doors.—The ends of the compartment should have as many doors as possible, and in no case should the doors be more than 3 feet apart. They should be heavy and securely made, hung on strong hinges, and should open outward so as to facilitate the rapid movement of cotton in case of fire.

Ventilators.—The top of each compartment should be provided with one or more approved metal ventilators.

Fire protection.—A connection of not less than a 6-inch pipe with a city water main of equal or larger diameter is necessary. One standard hydrant for each three compartments should be placed opposite the front or rear ends. Not less than 100 feet of approved 2½-inch cotton, rubber-lined hose should be kept attached to each hydrant. Six casks and 12 pails filled with water must be provided for each 600 bales storage capacity.

SCHEDULE FOR RATING.

	City.[1]		Town.[1]	
	First class.	Second class.	Third class.	Fourth class.
Basis rate	$1.15	$1.25	$1.35	$1.50

[1] For classification of cities and towns, see p. 28.

This schedule of rates is subject to material reduction if the property is protected with standard automatic sprinkler equipment.

Add for deficiencies as follows:

1. Floors, not standard	$0.10
2. Variation from requirements as to number of doors, 5 cents for each door; total charge not to exceed	.15
3. Skylights, not standard	.10
4. Private fire protection, none, or not standard	.25
5. Fire pails and casks of water, none, or insufficient supply (6 casks and 12 pails to compartment)	.50
6. Storage of lime or oils or use of any portion of building for stabling purposes or for "camping"	.50
7. Accumulation of loose cotton on floor or in other than closed bins	1.00

Make deduction as follows:

Chemical fire engine (40-gallon, approved, on wheels, having sufficient hose attached to reach any part of plant or premises): A deduction of 5 per cent of final rate will be granted, except on risks that have full credit in rate for standard private fire protection; said deduction not to be less than 5 cents and not to exceed 30 cents.

ADAPTATION OF STANDARD I.

The standard warehouse with compartments limited to 600 bales capacity, as just described, is used largely by the cotton mills. The Office of Markets and Rural Organization has just published the results of an extensive survey in Georgia and North Carolina, which showed that a large number of mills have constructed warehouses of this type and equipped them with automatic sprinklers at a cost of less than $3 per bale capacity. The same investigation showed that the rate of insurance on cotton stored in such buildings, when fully equipped with automatic sprinklers and fire hose, is frequently less than 12½ cents on $100 of value.[1] While buildings of this character are used largely by the mills and designed primarily to meet their particular needs, it would be well for any person preparing to erect either a public or private warehouse to consider very carefully the merits of this type.

No attempt is made to convey the impression that every public warehouse of this type would be able to insure cotton at 12½ cents per $100. The underwriters' association does not publish any schedule for rating such sprinkled risks, but it seems to be safe to state that cotton stored in such a building and in a first-class city could be insured for 25 cents, or for 30 cents in a second-class city, 35 cents in a third-class town, and 40 cents in a fourth-class town. The cotton mills are able to get a much lower rate on their own warehouses in the mill yards because the mill mutual insurance companies make special rates on this particular kind of risk. A certain mutual insurance company also writes insurance on such private warehouses at a much lower rate than the so-called "old-

[1] Nixon, Robert L. Cotton Warehouses: Storage Facilities now Available in the South. U. S. Department of Agriculture, Bulletin No. 216, 1915.

line" companies. When a person is building a warehouse for private use in which his own cotton will be stored largely, he can often cut the public rate materially by having his storage house conform very closely to the standard as outlined. It will be seen that this particular type of warehouse will save much in insurance rates, especially when it is used for private purposes, and it has many advantages as a public storage house.

STANDARD II.—COTTON WAREHOUSE OF FRAME CONSTRUCTION (DETACHED).

In capacity, arrangement of doors, and general construction, Standard II is exactly the same as Standard I. However, in Standard II each compartment is a separate warehouse. These houses

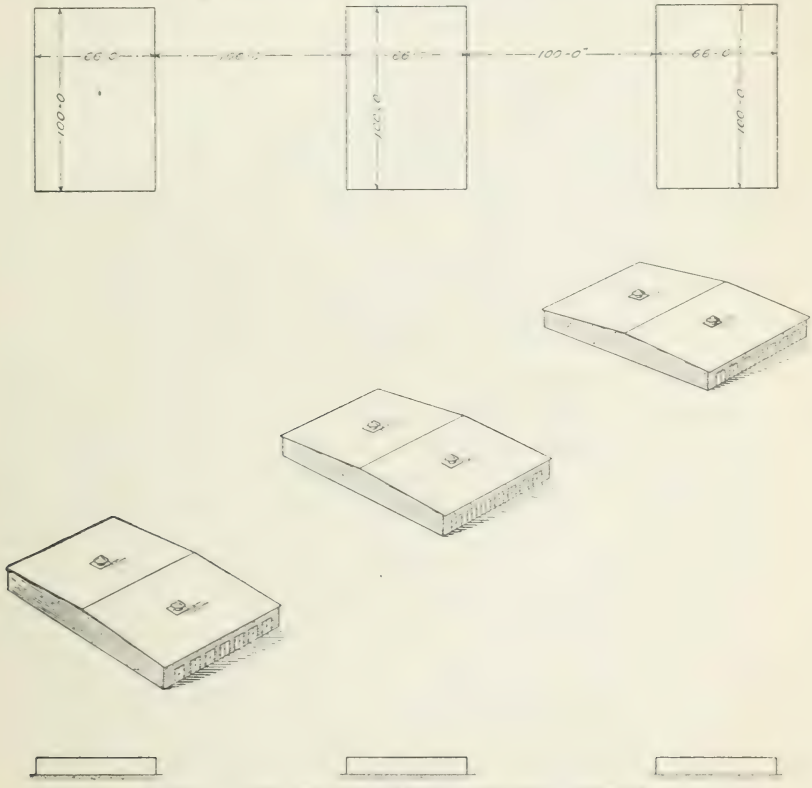


FIG. 2.—Cotton warehouse of frame construction—detached.

must be placed at least 100 feet apart, and must be no nearer other buildings than that distance. This avoids the use of brick division walls. The ends, roof, floor, etc., are exactly the same as in Standard I, but the side walls are of wood. In this type, two board walls and a space of 100 feet are substituted for the standard fire wall separating the compartments in Standard I. The diagram (fig. 2) shows three of these compartments properly arranged. The requirements for private fire protection are the same as in Standard I.

SCHEDULE FOR RATING.

	City.		Town.	
	First class.	Second class.	Third class.	Fourth class.
Basis rate	$2.15	$2.25	$2.35	$2.50

Charges for deficiencies for this type are the same as for Standard I. Deductions as outlined under Standard I will also apply to Standard II.

ADAPTATION OF STANDARD II.

The standard warehouse of frame construction limited to 600 bales storage capacity is not to be recommended for general use. Where real estate is so cheap that it can hardly be considered as an item in the cost of a storage plant, and where cotton is to be handled in small lots of 500 or 600 bales, it might be to advantage to construct such houses, but in most cases the additional land required would cost much more than it would to erect a warehouse with several compartments separated by standard fire walls. Where large quantities of cotton are handled, the cost of trucking would be greatly increased by having each compartment separated from the others by a space of 100 feet. It is also well to take into consideration the fact that insurance on cotton in such buildings is much higher than it is in the building described under Standard I.

STANDARD III.—CLOSED COTTON WAREHOUSE (OR COMPRESS), COMPARTMENTS LIMITED TO 1,000 BALES' CAPACITY.

Construction of building.—The outside walls of a one-story building conforming to this standard should be of brick not less than 13 inches in thickness, with or without standard parapets. (See p. 32 for requirements of thickness of walls for buildings more than one story high.) The roof should be of slate, metal, or approved composition. The storage capacity of no compartment should exceed 1,000 bales, which requires about 72,000 cubic feet. If divided into compartments, the division walls should be at least 17 inches in thickness for a one-story building and should extend at least 2 feet above the roof. All joists should rest on ledges, metal hangers, or metal wall plates. Each compartment should have one or more standard fireproof doors, not more than 40 feet apart, opening outward, in each outside wall, whether at end or side of compartment. The floors should be of earth, shell, cement, or some other noncombustible material. Monitors, skylights, and roof lanterns, or texas, are not allowed unless they are made of wired glass properly set in metal frames. The top of each compartment should be provided with one or more metal ventilators. The compress tower should be of metal or some other noncombustible material.

Samples.—All cotton stored in a warehouse of this standard should be graded, and the samples, together with books and other records, should be properly stored at a safe distance from the storage compartments.

Fire protection.—Six casks and 12 pails filled with water should be provided for each 1,000 bales storage capacity. Not less than a 6-inch connection with a city main of equal diameter or larger is required. One standard hydrant for each three compartments or fraction thereof is necessary. The hydrants should be placed opposite the front and rear ends of the compartments. Not less

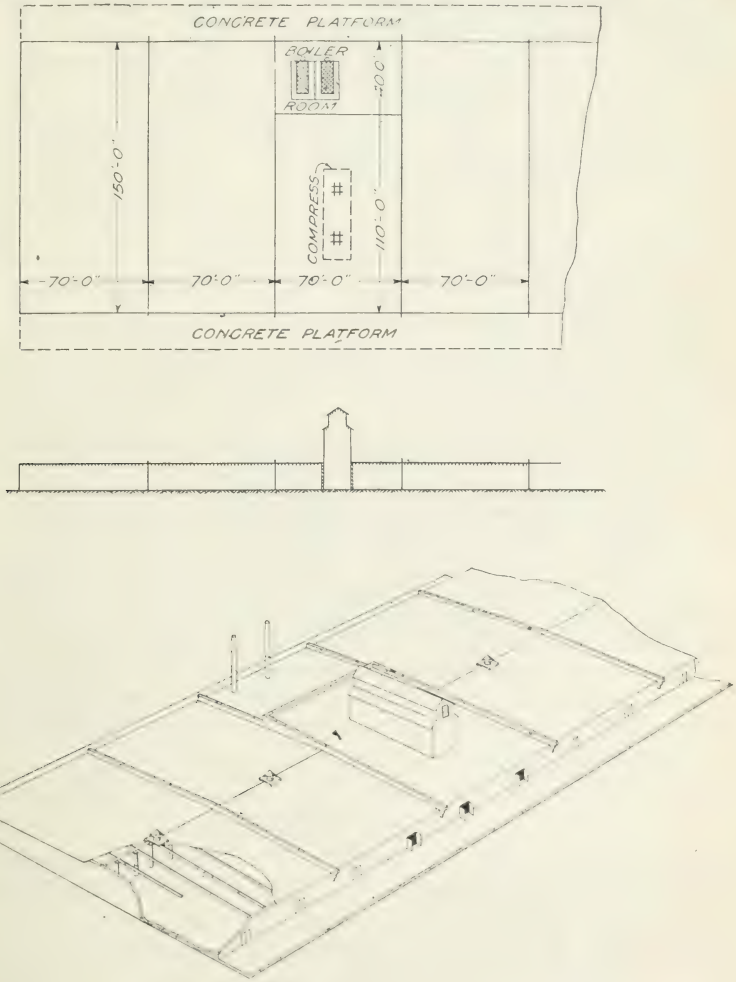


FIG. 3.—Closed cotton warehouse (or compress), compartments limited to 1,000 bales capacity.

than 100 feet of approved cotton, rubber-lined hose should be attached to each hydrant, and a standard hose house fully equipped should be erected over each hydrant.

An approved and convenient arrangement for a warehouse of this type is shown in figure 3. This diagram shows a warehouse of one compress compartment, as indicated. A warehouse conforming to Standard III may be constructed without a compress.

SCHEDULE FOR RATING.

	City.		Town.	
	First class.	Second class.	Third class.	Fourth class.
1. Standard mill construction with fire walls and approved roof	$1.15	$1.25	$1.35	$1.50
2. Same as No. 1, with shingle or unapproved roof	1.40	1.50	1.60	1.75
3. Same as No. 1, except that walls are of concrete blocks or of corrugated iron	1.65	1.75	1.85	2.00
4. Frame building with approved floor	1.90	2.00	2.10	2.25
5. Frame building with shingle or unapproved roof	2.15	2.25	2.35	2.50

This schedule of rates is subject to material reduction if the property is protected with standard automatic sprinkler equipment

Add for deficiencies as follows:

1. Height:	
For 2-story building	$0.10
For 3-story building	.25
For 4-story building	.50
For 5-story building	.75
2. Variation from standard as to joist supports	.10
3. Outside brick walls, not standard	.25
4. One outside frame or iron-clad wall	.50
5. Division walls, not standard	.25
6. Excess in capacity of compartments or warehouses:	
Over 1,000 bales and not exceeding 1,500 bales	.25
Over 1,500 bales and not exceeding 2,000 bales	.50
Over 2,000 bales and not exceeding 2,500 bales	.75
For each 1,000 bales additional	.25
7. Variation from requirements as to number of doors	$0.05 to .15
8. Skylights, monitors, or roof lanterns, not standard	.10
9. Private fire protection, none, or not standard	.25
10. Fire pails and casks of water, insufficient supply (i. e., less than 6 barrels and 12 fire pails for each 1,000 bales capacity)	.50
11. Storage of lime or oils, or use of any portion of building for stabling purposes or for "camping"	.50
12. Accumulation of loose cotton on floors or in other than closed bins	1.00

ADAPTATION OF STANDARD III.

This standard is used largely for public warehouses, especially in the small towns of the Southeast. It will be seen in the "Schedule for rating" that it may be of standard brick construction with approved roof, or, with unapproved roof, built of concrete blocks, corrugated iron, or of frame construction. When a warehouse is exposed within a hundred feet it would seem to be advisable to have it conform to Standard III, but outside walls of corrugated iron or wood are not to be recommended in such cases. As a rule, the more costly building is to be recommended. Such a building will command a much lower insurance rate and it will prove more satisfactory in many respects. Where a warehouse is not exposed within 100 feet, it is well to consider Standard I. A building conforming to that standard, but with a storage capacity of 1,000

bales, can be constructed for less money than where the outside walls are of standard brick construction. There would be only a slight difference in insurance rates.

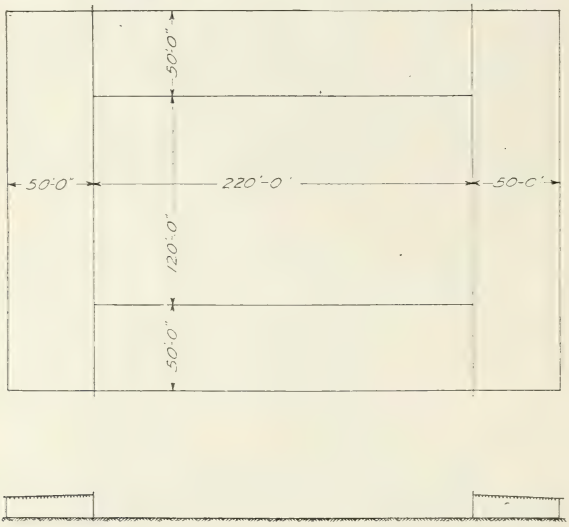
STANDARD IV.—COTTON WAREHOUSE WITH OPEN COURT OR YARD.

Construction of building.—The outside brick walls should be not less than 13 inches thick, with or without a standard parapet, for a one-story building. (See p. 32 for required increase of thickness for additional height.) The roof should be of slate, metal, or standard composition. The building must be subdivided into compartments with a storage capacity not exceeding 1,000 bales each, or 72,000 cubic feet. The division walls should be of brick not less than 17 inches in thickness, and should rise at least 2 feet above the roof and extend at least 3 feet beyond the apron of the roof. The joists of compartments should rest on ledges, metal hangers, or metal wall plates. Each compartment should have one or more outside (not court) standard doors, not more than 40 feet apart, opening outward. The floors should be of earth, shell, concrete, or other noncombustible material. The standard width of the open court from shed to shed is 100 feet or more. In figure 4 is shown an approved diagram for this type of warehouse.

Doors to court.—Sliding doors to the open court should be of light frame construction, covered with approved terneplate, with single hook joints running horizontally and double lock seams running vertically on each side. The space between the two layers of tin should be filled with asbestos, magnesia, or some similar fire-resisting substance. A rolling, corrugated steel shutter which can be easily rolled or pulled down may be used in lieu of sliding doors. All sliding doors must extend at least 3 inches over the masonry at the sides and top of doorway openings and lap over each other at least 6 inches. The rail or track should be of wrought iron, secured to the walls with bolts passing through the walls, and fastened with washers and nuts. The hangers should be of wrought iron and fastened to the door by bolts passing through it and secured with nuts. Binders of iron, secured to the masonry in the same manner as catches and hanger blocks, should be used. The binders should be so placed at the top as to prevent the doors from rolling off the track at either end, and at the bottom to hold the door in position when closed.

Fire protection.—A connection of not less than 6 inches with a city main of at least equal size should be required. One standard fire hydrant should be provided for each three compartments or fraction thereof, with not less than 100 feet of 2½-inch cotton, rubber-lined hose attached to each hydrant at all times. A standard hose house, fully equipped, should be erected over each hydrant. Six or more fire pails filled with water should be suspended in front of each standard compartment and press room, and a proportionately

larger number when the compartment exceeds the standard. A sufficient number of casks filled with water should be kept outside the door of each compartment, and three casks of water should be placed inside of each compartment. A watchman should be constantly on duty day and night, and should be provided with an approved watch clock, or report to an approved central station.



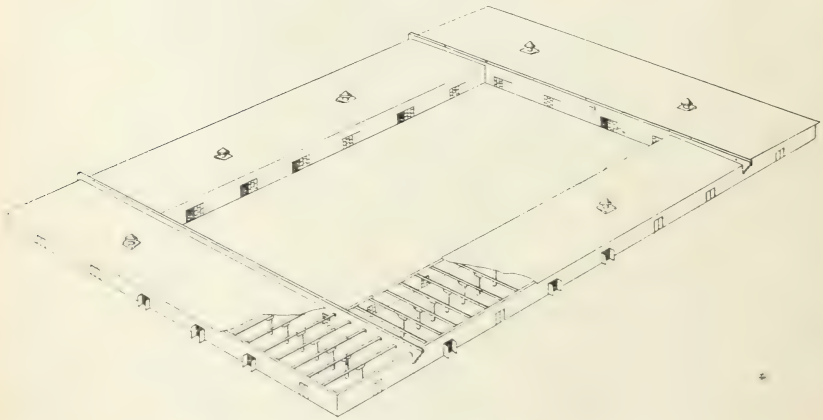


FIG. 4.—Cotton warehouse with open court or yard.

Samples.—Samples of cotton on storage should be kept entirely away from the warehouse, so as to more certainly insure their preservation in case of loss of cotton.

Smoking.—No smoking in or about the warehouse will be warranted in the insurance policy.

Compress.—Where a compress is connected with the foregoing standard warehouse, the boiler and machinery should be separated

by walls not less than 17 inches thick, which should rise above the roof at least 2 feet. All openings in this wall should have standard fire doors on each side of the walls. These doors should be closed at all times when the compress is not in operation. All openings in the outside walls on, to, or overlooking the platform should be protected by single fire doors. The compress tower should be of all-metal or other noncombustible material.

Cotton in court.—Storage of cotton in courts is prohibited by a condition in the policy unless the warehouseman states at the beginning of the season that he wishes to use the court for storing, in which case the risk is rated for its full capacity, and such rating is not to be changed during the season unless it has been in effect at least 90 days.

SCHEDULE FOR RATING.

	City.		Town.	
	First class.	Second class.	Third class.	Fourth class.
Basis rate	$1.15	$1.25	$1.35	$1.50

This schedule of rates is subject to material reduction if the property is protected with standard automatic sprinkler equipment.

Add for deficiencies as follows:

1. Height:	
For two-story building	$0.10
For three-story building	.25
For four-story building	.50
For five-story building	.75
2. Variation from standard as to joist supports	.10
3. Openings to open court not protected by standard sliding doors or doors not standard	.25
4. Outside brick walls of less than 13 inches thickness	.25
5. For frame or ironclad outside (not court) walls	.75
6. For outside concrete-block walls (not court)	.50
7. Division walls, not standard	.25
8. Shingle roof or composition roof, not standard	.25
9. Excess in capacity of compartments and (or) warehouses and (or) courts:	
Over 1,000 bales and not exceeding 1,500 bales	.25
Over 1,500 bales and not exceeding 2,000 bales	.50
Over 2,000 bales and not exceeding 2,500 bales	.75
For each 1,000 bales additional	.25
10. Variation from standard as to outside doors (number)	.05–.15
11. Floor other than standard	.25
12. Private fire protection, none or not standard	.25
13. Fire pails and casks of water, insufficient supply (i. e., less than 6 casks and 12 fire pails for each 1,000 bales capacity)	.50
14. No watchman and approved watch clock	.50
15. Storage of lime or oils or use of any portion of building for stabling purposes or for "camping"	.50
16. Accumulation of loose cotton on floors or in other than closed bins	1.00

Deduction for chemical fire engines will be made as outlined in Standard I.

ADAPTATION OF STANDARD IV.

The open-court warehouse has very much the same use as Standard III. This warehouse is readily adaptable for use as a large public storage plant. This is especially true where the house occupies a full block. Where available land is in a narrow strip, it is frequently necessary to use Standard III, but in most cases where the warehouse has a storage capacity of not less than 10,000 or 15,000 bales it is advisable to use the open-court type.

STANDARD V.—STANDARD FOR HOLLOW-SQUARE OR OPEN-COURT WAREHOUSE OF FIRE-RESISTIVE CONSTRUCTION.

Construction of building.—This standard requires that the building should be constructed of reinforced concrete or standard brick throughout. The building should be constructed of an approved mixture of concrete (where concrete is used), properly reinforced with steel. Concrete blocks (whole or hollow) will not be considered reinforced. The area of any compartment should not exceed 2,950 square feet (59 by 50 feet) and the area of any compress compartment should not exceed 5,644 square feet (83 by 68 feet). (See fig. 5 for approved diagram). The height of any storage compartment should not exceed 13 feet 8 inches at the lower side or 16 feet 8 inches at the higher side.

Walls, doors, etc.—The outside walls should be at least 9 inches thick if concrete, or 13 inches thick if brick. Division walls should be 4 inches thicker than required for outside walls. The wall around the compress tower above the main roof should be 6 inches thick and should be constructed of reinforced concrete. All walls should have parapets 3 feet above the roofs of the same thickness as the wall. The parapets should be parallel with the contour of the roof and properly coped if built of brick. The floors should be of noncombustible material, with no air space underneath. To meet the standard, the building should have a concrete roof 4 inches thick, covered with approved composition roofing. All columns, girders, and cross girders supporting the roof should be of reinforced concrete.

No windows should be allowed except in the office and compress tower. Doors should be allowed only in outside and court walls, and these should be fully standard in all respects. Each storage compartment should have one or more standard fireproof doors, not more than 50 feet apart, opening outward. On the court side of the walls the doors must be placed before each tier of cotton. The court should be at least 200 feet wide, and no combustible material of any kind should be permitted in the court.

Arrangement, etc.—Not over 600 bales should be stored in any one compartment. The cotton bale should be laid flat on the side, and piled not to exceed 5 bales high. The sizes listed above will allow the storage of 600 standard bales, five tiers high, 120 bales to

the tier. Loose cotton should not be allowed to accumulate, but should be picked up before closing the compress and placed in an

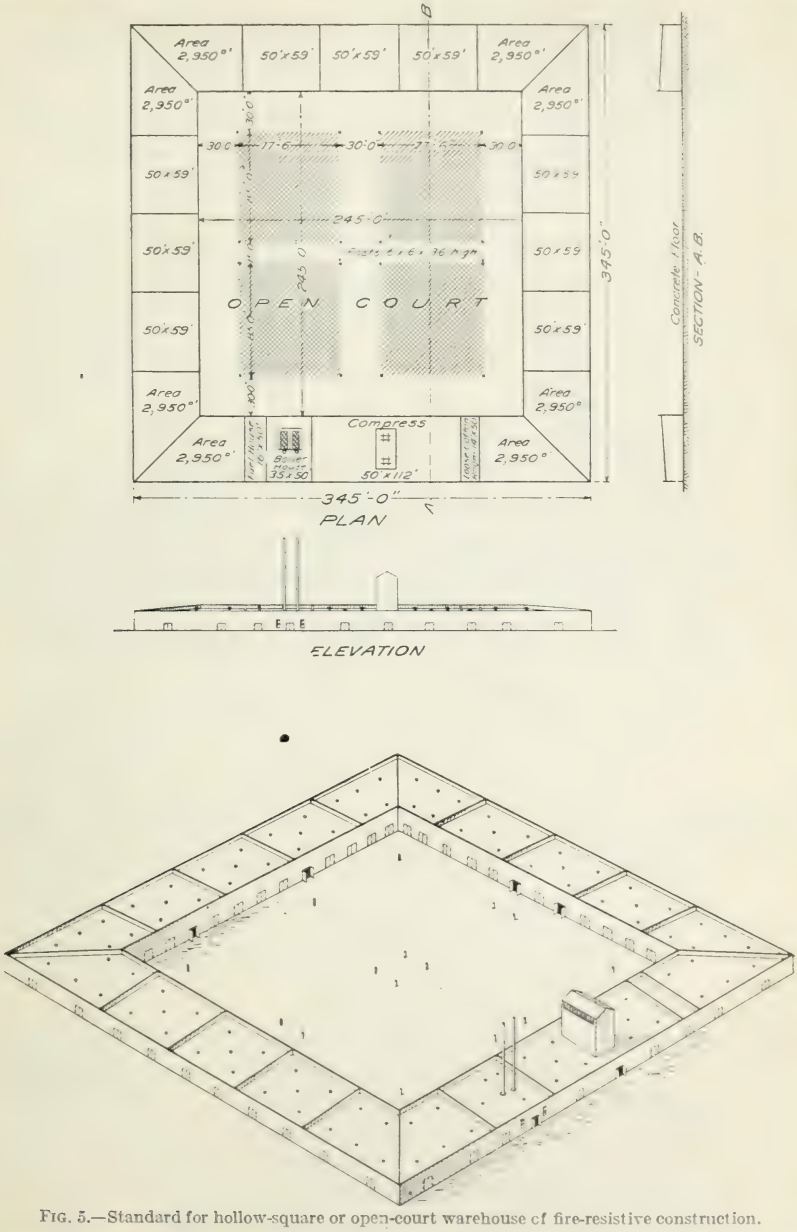


FIG. 5.—Standard for hollow-square or open-court warehouse of fire-resistive construction.

approved loose room with the samples. The records also should be kept a safe distance from the storage compartments. Cotton left in the court over night should not be piled or headed, and should be

covered entirely with tarpaulins, properly battened down to prevent the wind from blowing them off the cotton. A clear space of 30 feet should be maintained between any cotton in the court and also in front of the compartments. A 15-foot aisle should be maintained longitudinally through the center of the court and a 30-foot aisle across the center of the court.

Boilers, fire protection, etc.—The boilers should be in a separate compartment of standard construction and should be well ventilated. Provision should be made for keeping fuel, oils, and waste in a safe place. Approved ash cans should be provided in order to prevent fire from this source. This standard also requires that a watchman with an approved clock should be on duty at all times when the plant is not in actual operation. A sufficient number of casks and pails should be placed in each compartment, in front of the compartments, and also in the open court. Yard mains should have a connection at least 6 inches in diameter with a city main of the same or greater diameter. A sufficient number of two or three way fire hydrants should be installed, as designated by the underwriters having jurisdiction, and be so located that the required number of standard fire streams can be brought to bear on all sides of the plant. Hydrants should be located 50 feet from the building and not over 200 feet apart. When automatic sprinklers are to be installed, plans and specifications will be furnished without cost upon application to underwriters.

SCHEDULE FOR RATING.

	Building.	Contents.
Basis rate:		
600 bales capacity	$0.68	$0.85
960 bales capacity	.85	1.10
For end of open court not closed by 7-foot close fence, add	.10	.10
For locomotives passing within 80 feet of open end, add	.50	.50

This schedule of rates is subject to material reduction if the property is protected with standard automatic sprinkler equipment.

Deduction for chemical fire engines is the same as outlined for Standard I.

ADAPTATION OF STANDARD V.

This type is used largely in cities by companies that try to give the most efficient service possible. It is needless to say that such a building commands a very low rate of insurance. Some compartments in such a house are frequently used for storage of cotton, while others in the same building may be used for storing merchandise and various other products. The first cost of such a building is high, but when the fact that the cost of insurance is greatly reduced and that the building will last almost indefinitely is taken into consideration, it will be seen that it is economical in many cases to erect a building of fire-resistive construction.

STANDARD VI.—STANDARD FOR SINGLE OR COMPARTMENT WAREHOUSE OF FIRE-RESISTIVE CONSTRUCTION.

In thickness of walls, roofs, floors, materials used, etc., this standard is practically the same as Standard V. The area of each single warehouse or compartment is 6,405 square feet (105 by 61 feet). The height of any single warehouse should not exceed 7 feet on the lower side and 10 feet on the higher side. Each single warehouse

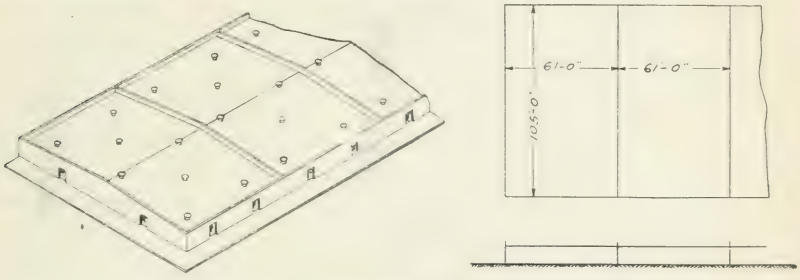


FIG. 6.—Standard for single or compartment warehouse of fire-resistive construction.

should have eight sliding doors, two to each wall. Not over 600 bales of cotton should be stored in any single warehouse or compartment, and they should be stored standing on end, one bale high only. A separate compartment should be provided for loose cotton, samples, records, etc. An approved diagram of this warehouse is shown in figure 6.

SCHEDULE FOR RATING.

	Building.	Contents.
Basis rate:		
600 bales capacity	$0.60	$0.85
960 bales capacity	.85	1.10

This schedule of rates is subject to material reduction if the property is protected with standard automatic sprinkler equipment.

Deduction for chemical fire engines is the same as outlined for Standard I.

ADAPTATION OF STANDARD VI.

This type of warehouse is used in much the same way as Standard V. However, Standard V is used chiefly in connection with compresses where a large amount of cotton is handled. Standard VI may or may not be used in connection with such a compress. Houses of this type are used generally by smaller plants.

STANDARD VII.—OPEN-SHED COMPRESSES AND PLATFORMS AND YARDS ATTACHED.

The open shed may be composed of one or more compartments. The storage capacity of no compartment should exceed 5,000 bales, or 55,000 square feet. Each compartment should be separated by standard brick division walls, 17 inches thick, without openings. The floors should be of heavy plank, laid on the ground with no space underneath. The roof should be of light frame construction, covered with gravel or approved composition. The roof and floor should be

supported independently of the brick division walls. Supporting joists or timbers may rest on corbels of division walls and be entirely self-releasing. Such sheds should have hydrants with not less than a 6-inch connection with city mains, and a sufficient amount of hose should be provided. Hose houses, built in conformity with national board requirements and with full equipment, such as wrenches and lanterns, should be placed over each hydrant.

SCHEDULE FOR RATING.

	City.		Town.	
	First class.	Second class.	Third class.	Fourth class.
Basis rate	$2.25	$2.50	$2.75	$3.00

This schedule of rates is subject to material reduction if the property is protected with standard automatic sprinkler equipment.

Add for excess capacity as follows:

Over 5,000 and not exceeding 6,000 bales	$0.10
Over 6,000 and not exceeding 7,000 bales	.25
Over 7,000 and not exceeding 8,000 bales	.50
Over 8,000 and not exceeding 10,000 bales	1.00
Over 10,000 and not exceeding 15,000 bales	2.00
Over 15,000 bales	3.00

Add for deficiencies as follows:

1. Fire protection, none or not standard	$0.25
2. Compress boilers not cut off by 17-inch brick wall parapeted 3 feet above roof, and (or) openings not protected by standard double fire doors	.50
3. Less than 6 casks and 12 fire pails, filled with water, for each 1,000 bales capacity	.50
4. No watchman and approved clock	.50
5. Storage of lime or oils or use of any portion of building for stabling purposes or for "camping"	.50
6. Accumulation of loose cotton on floors or yard or in other than closed bins	.50

Deduction for chemical fire engines is the same as outlined for Standard I.

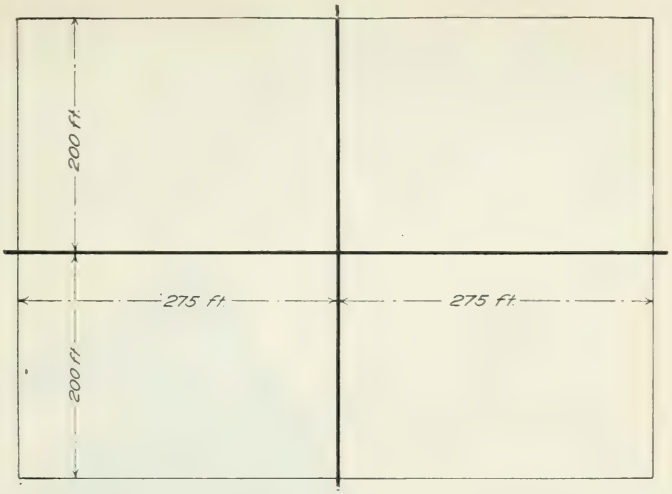
ADAPTATION OF STANDARD VII.

These sheds are used frequently in connection with compresses. In figure 7 is shown a complete and approved arrangement of such a shed with four compartments. These sheds have a very low cost compared with their storage capacity, but insurance rates are so high that they are not usually considered economical, especially when cotton is stored any considerable length of time. Much of the cotton handled at such a plant, however, is considered in transit and is covered by "floaters." In such cases a cheap shed is economical.

STANDARD VIII.—EMERGENCY SHEDS.

The specifications for emergency sheds given here are recommended by the Southeastern Underwriters' Association. These sheds should be located at least 100 feet in the clear, not being exposed to passing locomotives or other sheds or buildings. A diagram of the construc-

tion and arrangement of a group of emergency sheds is shown in figures 8 to 11.



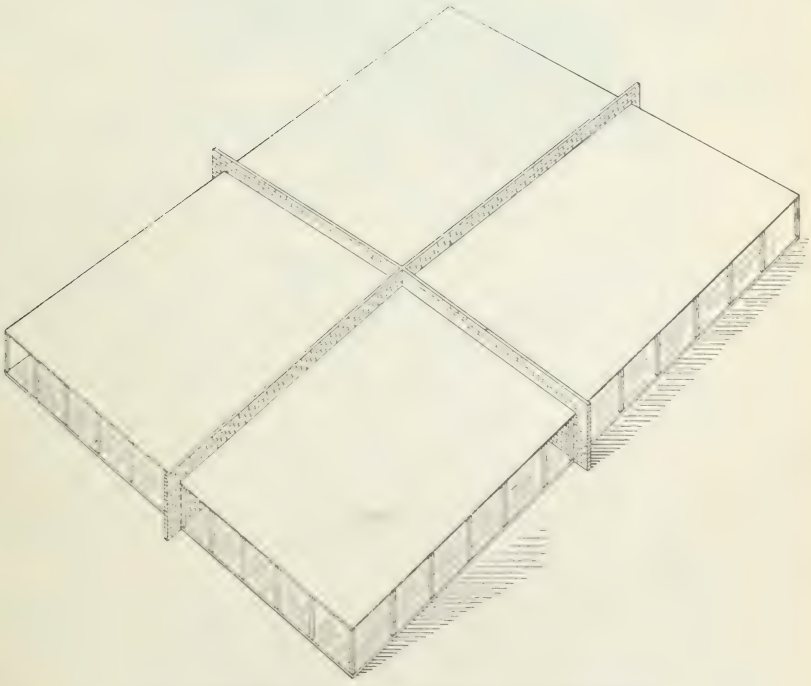


FIG. 7.—Open shed compresses and platforms and yards attached.

Construction.—These sheds or units should be constructed of light framework, each shed or unit being approximately 16 by 35 feet. The roof should be of joist construction, covered with approved com-

position roofing and supported by eight posts. Six of the posts should be 4 by 4 inches by 6½ feet long and the other two should be 4 by 4 inches by 27 feet long. Three posts should be placed at each end, supporting the eaves of the shed, which should extend within 4 feet of the ground. Two posts in the middle of the shed should support a 2 by 6 inch ridgepole. All posts should be set 12 inches in the ground. The sides and ends of the sheds may be open if not exposed within 100 feet to a railroad main line or open-end switch tracks. It is recommended, when feasible, that composition roofing should be

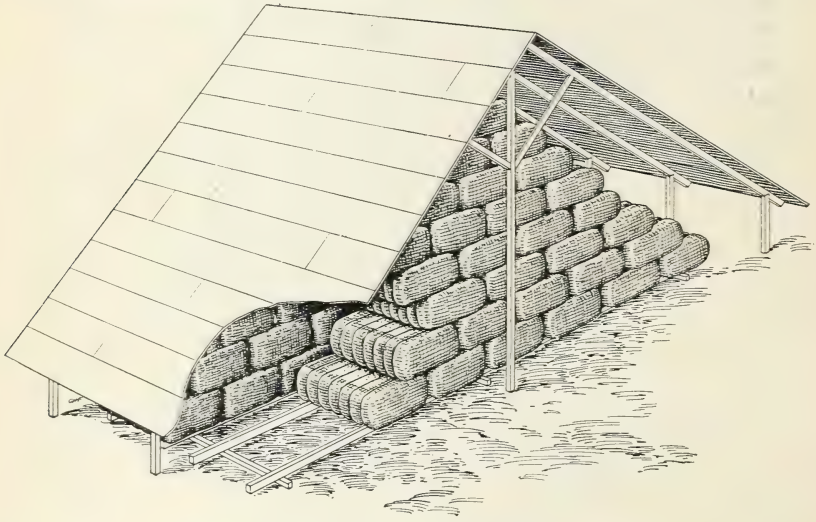


FIG. 8.—Emergency sheds—single unit.

used to inclose the ends of the shed from the peak of the roof down to within 4 feet of the ground, in order to protect the cotton entirely from weather. Metal sheets should not be used for inclosing the ends or sides of sheds. (A single unit, or shed, is shown in figure 8.)

Arrangement of cotton.—Cotton to be stored in sheds (units) should be arranged in two tiers (see fig. 11), the bales forming each tier being placed end to end. No tier should exceed 36 bales. The bottom layer of each tier should contain 8 bales. Each layer from the bottom up should contain 1 bale less than the layer next below, no tier being more than 8 bales high. The total number of bales in any shed or unit should not exceed 72.

The tiers should be supported on stringers, as follows: There should be three 4 by 4 by 10 inch mud sills laid on the ground crosswise with the shed and lengthwise with the bale or at right angles to the line of tiers. (See figs. 8 and 11.) These in turn should support four 4 by 6 inch by 15 foot stringers laid at right angles to the mud sills and spaced about 3 feet apart so as to properly support the bales. (Four of these stringers are required for each tier, as it requires two

lengths to one end of the shed.) The bottom line of the lower layer of cotton should be at least 10 inches above the ground and should be piled in tiers so arranged that the eaves on the extreme ends of the roof extend 3 feet beyond the outer line of cotton.

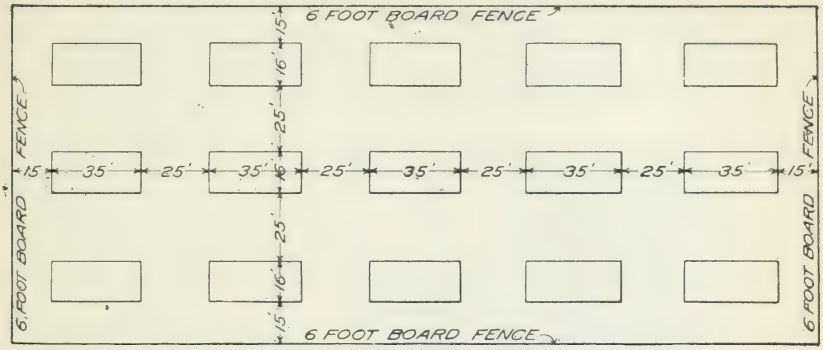


FIG. 9.—Emergency sheds—plan for 1 group of 15 units.

Arrangement of units.—The units should have at least 25 feet of clear space on all sides and ends and should be arranged in groups of not exceeding 15 units. (See fig. 9.) These groups should be inclosed with a 6-foot board fence, with 15 feet clear space between the fence and the ends or sides of the sheds or units. (See fig. 10.)

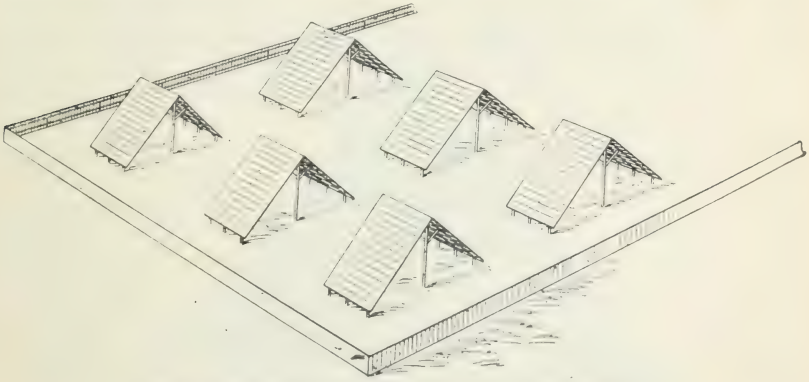


FIG. 10.—Emergency sheds—isometric view of sheds and fence.

A group of 15 units requires an inclosed area of 128 by 305 feet. Where more than one group is used they should be at least 100 feet apart. Two or more groups may be included in the same inclosure, provided 100 feet clear space is maintained between each group.

The insurance policy covering risks outlined above should have a warranty attached showing that not exceeding 72 bales will be stored in any one unit and not exceeding 1,008 bales in any one group.

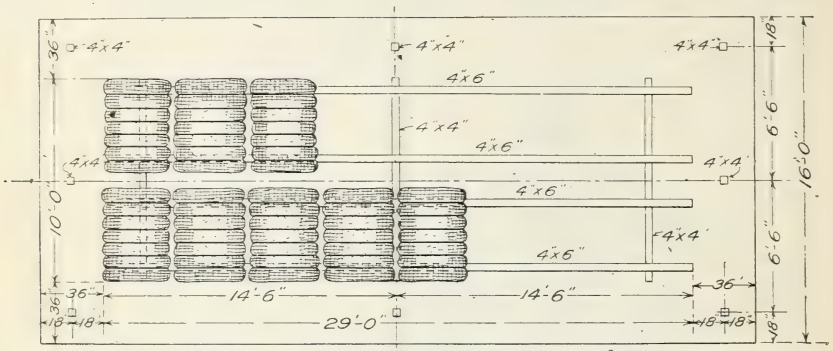
SCHEDULE FOR RATING.

The basis rate on cotton stored in emergency sheds as outlined is $1.75 in cities or towns. Where such sheds do not have standard

fire protection, or the requisite number of casks and pails, 25 cents must be added to this basis rate. Where no watchman with an approved clock is on duty, an addition of 25 cents must be made.

ADAPTATION OF STANDARD VIII.

Emergency sheds are not to be recommended as a place for permanent storage. It may be seen readily that these sheds require



PLAN OF UNIT SHOWING ARRANGEMENT OF COTTON.

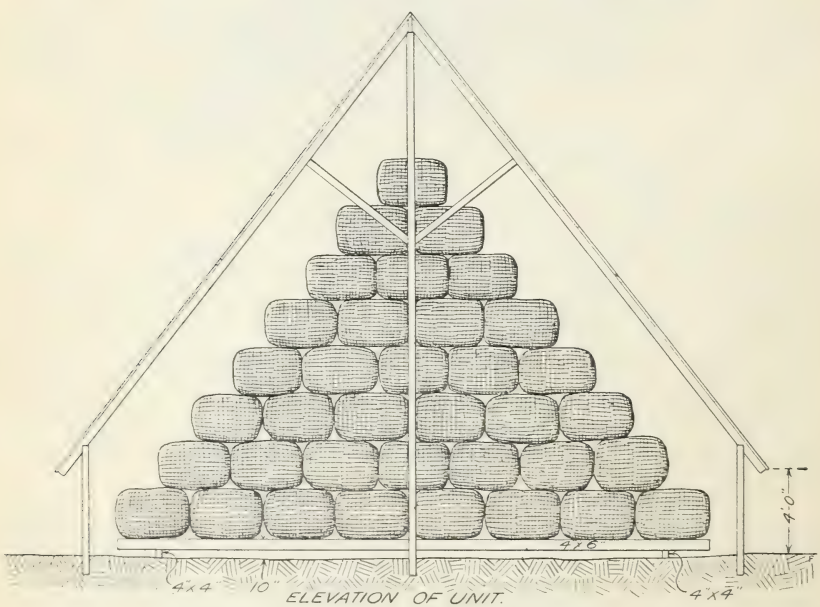


FIG. 11.—Emergency sheds—arrangement of cotton in unit.

a large amount of land and would be very inconvenient where cotton had to be handled frequently. When conditions are such that a considerable amount of cotton must be stored pending better market conditions, but where permanent storage is not desirable, it might be well to erect such sheds, inasmuch as the original cost of construction is very low. As the name indicates, they are intended entirely to meet emergencies, and not as permanent storage sheds.

Estimate of bill of material and approximate cost for building one shed.

770 feet lumber, at $18 per M	$14.00
Nine rolls roofing, at $2.50 per roll	22.50
Nails	1.00
Labor	10.00
Total approximate cost for one shed	47.50

Estimate of bill of material and approximate cost of building a group of sheds.

Group of 15 sheds, at $47.50	$712.50
5,049 feet lumber for fence, at $18 per M	91.00
Nails for fence	2.00
Labor for fence and 15 units	175.00
Total approximate cost for group	980.50

MISCELLANEOUS FIRE-INSURANCE SCHEDULES.

Schedules for rating cotton when stored in streets and various places other than the standard warehouses described are given below:

COTTON IN STREETS.

Rate in first-class city, if within 500 feet of standard city hydrants	$4.25
Rate in second-class city, if within 500 feet of standard city hydrants	4.50
Rate in third-class town, if within 500 feet of standard city hydrants	4.75
Rate in fourth-class town	5.00

COTTON IN YARDS AND IN OPEN OR COVERED PLATFORMS, NOT EXPOSED WITHIN 100 FEET BY COMPRESS (STORAGE LIMITED TO 5,000 BALES).

	City.		Town.	
	First class.	Second class.	Third class.	Fourth class.
Basis rate	$2.00	$2.25	$2.50	$2.75

Add for excess capacity as follows:	
Over 5,000 and not exceeding 6,000 bales	$0.10
Over 6,000 and not exceeding 7,000 bales	.25
Over 7,000 and not exceeding 8,000 bales	.50
Over 8,000 and not exceeding 10,000 bales	1.00
Over 10,000 and not exceeding 15,000 bales	2.00
Over 15,000 bales	3.00
Add for deficiencies as follows:	
1. Fire protection, none or not standard	$0.25
2. Less than 6 casks and 12 pails of water for each 1,000 bales capacity	.50
3. No watchman with approved watch clock	.50
4. Storage of lime or oils or use of any portion of premises for stabling purposes or for "camping"	.50
5. Accumulation of loose cotton on yard or platform or in other than closed bins	1.00
6. If inclosed by barbed-wire fence	.25
Make deductions as follows:	
7. If inclosed by 7-foot high close board fence, deduct	.15

Deduction for chemical fire engines the same as in Standard I.

COTTON IN BALES ON RIVER BANKS AND PLANTATIONS.

In buildings other than gin houses.

1. Standard mill construction with fire walls and approved roof	$2.50
2. Same as 1, with shingle or unapproved roof	2.75
3. Frame building with corrugated iron sides and approved roof	3.00
4. Wooden building with approved roof	3.25
5. Wooden building with shingle or unapproved roof	3.50
6. Cotton in the open	3.50

On cotton wharves.

Standard: One-story frame or iron-clad building, not exceeding 25,000 square feet, under first-class city fire protection. Private fire protection to conform to standard requirements. Fire pails every 50 feet; watchman and approved watch clock.

	First-class city.	Second-class city.	Third and fourth class towns.
Basis	$2.25	$2.40	$2.50

Add for deficiencies as follows:

1. Excess area, for each 5,000 square feet above 25,000 but not to exceed 50,000 square feet	$0.01
For each 10,000 square feet in excess of 50,000 square feet	.01
2. Roofing not standard	.25
3. For second story (no charge for office occupancy above first story)	.10
4. Heating by stoves unsafely arranged	.25
5. Lights, kerosene oil, acetylene, or gas, with swinging brackets	.10
6. Steam hoisting engine with boiler, or wood cutting on pier	.25
7. If boiler stack is without spark arrester	.25
8. Age and general condition	$0.05 to .25
9. No standard private fire protection (two water supplies required)	.25
10. Casks of water and fire pails, none	.10
11. Watchman and approved watch clock, none	.25

Make deductions as follows:

1. For uncovered wharf	.50
2. If covered pier of steel-frame construction throughout	.25
3. For pier built all on land or filled in underneath, deduct for contents rate.	.10
4. For fire-boat protection, according to efficiency	$0.05 to .25
5. For piers having all reinforced concrete foundations and piling (on piers only; no deduction for contents)	.25

Deduct for chemical fire engines the same as in Standard I.

GENERAL CONSIDERATIONS RELATING TO COTTON STORAGE AND FIRE INSURANCE.

CLASSIFICATION OF CITIES AND TOWNS.

For convenience in quoting insurance rates, cities and towns are divided into four classes:

First-class city.—This class requires that the city have an efficient, fully paid fire department, with standard equipment throughout,

and waterworks that will insure an ample supply of water under the proper pressure at all times. The streets must be paved and standard in width, an efficient police force must be maintained, and the city must have proper ordinances for assuring caution in regard to fire. It is also necessary for a first-class city to have well-defined fire limits.

Second-class city.—The requirements for a second-class city are very much the same as for the first-class, except that the fire company may be only partly paid, but it must be in charge of a competent chief. The streets need not be paved, and the requirements in regard to equipment are not so rigid as in class 1.

Third-class towns.—In this class the fire company is voluntary, but must be under a competent chief. This voluntary fire company must be provided with adequate hose wagons or hose reels and a sufficient quantity of standard 2½-inch cotton hose. The town must have standard waterworks and a fire alarm centrally located.

Fourth-class towns.—This class includes towns and villages having no approved waterworks or fire department.

INSURANCE RATES.

Explanation.—In discussing insurance rates every effort has been made to give authentic information. The data which have been used are taken from the rates quoted by the Southeastern Underwriters' Association. In many instances the exact language employed in "Rates, rules, and forms" has been used. After this material was prepared it was submitted to experienced insurance men. It is confidently believed that every statement made is correct, but at the same time no responsibility is assumed for the correctness of the rates quoted in this bulletin.

Segregation.—In controlling or preventing fires one of the fundamental principles is segregation. This is accomplished in various ways. One way is to erect small buildings a sufficient distance from each other or from other buildings, so that if one house be completely burned none of the others will be affected by the fire. When larger buildings are erected, division or fire walls divide the space into compartments. A fire in one compartment may destroy all of the contents and the combustible portion of the building without affecting other adjoining compartments.

This plan of segregation is very important in the case of cotton, for it is of such an inflammable nature that it produces a flash fire. This is the case particularly with cotton in the form in which it is ordinarily stored. It is not properly wrapped at first, and, after it has undergone frequent samplings it reaches the warehouse in a very ragged condition. Much of the lint is not covered at all, and this loose lint is sometimes hanging from the bale. These methods leave

the bale in such a condition that a spark will sometimes start a blaze which will flash over a loose lot of cotton in a very short time. When hundreds of bales are stored in one compartment this fire will flash from one bale to the other and frequently will extend over a lot of a thousand bales in a very few minutes. It can be seen readily that cotton stored in large quantities in a single compartment would be subject to a very costly fire, but a large warehouse might be divided into several smaller compartments and so avoid an extensive fire. This is the principle on which the insurance companies base their specifications.

Automatic sprinklers.—The automatic sprinkler also has proved to be of very decided advantage in protecting cotton warehouses from fire damage. By means of automatic sprinklers a fire automatically releases the water which is to isolate it. A detailed investigation of 90 fires in cotton warehouses under sprinklers shows that the average number of heads opening was 13.5 per cent, while in 52 per cent of the cases less than 10 heads opened. Later in this bulletin a brief description of a modern sprinkler system is given, which will show just how this desirable end is accomplished.

A study of fires in cotton warehouses which are protected by automatic sprinklers shows that out of a total of 159 fires, 69, or 43.4 per cent, were entirely extinguished by the sprinklers, and 74, or 46.5 per cent, were successfully held in check, making a total satisfactory sprinkler record of 143 fires, or 89.9 per cent. Of the 16 fires which were classed as unsatisfactory, in 8 cases the water was shut off from the sprinklers; in 2 cases the water supply was defective; 1 fire was due to faulty building construction; and 3 to obstruction to distribution. Of all of these cases, 13 were really not attributable to the standard sprinkler equipment in the standard warehouses, and in only 1 case was it found that the hazard of occupancy was too severe for the average sprinkler system.

LOCATION OF A WAREHOUSE.

It is very important to have a cotton warehouse conveniently located on a sidetrack. This saves drayage, which is a considerable item when the business is large. However, the warehouse should not be within 100 feet of the main line of a railroad or a sidetrack which extends beyond the building, for if it is so located the insurance rate will be increased. This is avoided by having the warehouse at or near the end of the sidetrack.

Many companies have made the mistake of deliberately locating the warehouse away from the business section. This is a serious mistake, for several reasons: First, there is the cost of drayage. In the second place, persons who are not directly interested in such a warehouse will patronize an establishment nearer the business center.

In many cases warehouses belonging to farmers' organizations have been located in the suburbs, or even in the country. It frequently happens that the cotton buyers of the town would use this space if it had been located properly, but they find it impossible to dray their cotton to the edge of town for storage, with the prospect of hauling it back to the station when it is sold. This causes the failure of many promising farmers' organizations.

PLATFORMS.

It is desirable to provide ample platform space at every warehouse. There should be a convenient place for unloading cotton from wagons, and, where cotton is shipped in, provision should be made for unloading it from cars. It is also necessary to have ample room for trucking when cars are being loaded or unloaded. In many markets cotton is sold by the farmers on public platforms near the warehouses. In such cases platforms should be of adequate proportions and so located that the cotton may be conveniently trucked to the warehouse or to the railroad platforms for loading. The mistake is made frequently of building platforms which are entirely too narrow next to the railroad. When different lots of cotton are being arranged for storage or for shipment, it is very desirable to have sufficient space to accommodate several hundred bales in addition to room for trucking. There are times during emergencies when such space can be used to advantage for temporary storage.

In figure 12, page 32, is shown a view of a well-arranged warehouse conforming to Standard I. It will be seen that there is ample platform space on either side and that the warehouse is not exposed by other buildings. Fully equipped hose houses are placed at opposite ends of the compartments. This view also shows the proper method of storing cotton, the bales being placed on end only one bale high, and a clear passage is maintained from one end of the compartment to the other. The view also shows in a very general way an automatic sprinkler system. In this case the tank is placed on the extended walls of the building, which arrangement is economical in that it saves in the cost of constructing a tower for the tank, but it is not altogether as satisfactory as a separate steel tower.

SALVAGE.

Another important consideration is the salvage. While loose cotton burns very rapidly, it frequently requires several days for a bale to damage seriously. In many fires the outside of the bales is burnt and damaged to a considerable extent, but where ample provision is made for removing the cotton from the burning building, it is frequently possible to save at least 50 per cent of the original value. It is for this reason that all standards require many doors

so that the cotton may be removed rapidly during the fire. For the same reason a risk takes a much higher rate when the warehouse is surrounded by a barbed-wire fence or when there are any other obstructions that might hinder the prompt removal of the cotton.

HEIGHT OF WALLS.

In all of the foregoing types the thickness of wall mentioned has been for buildings one story high. The standards for fire walls for

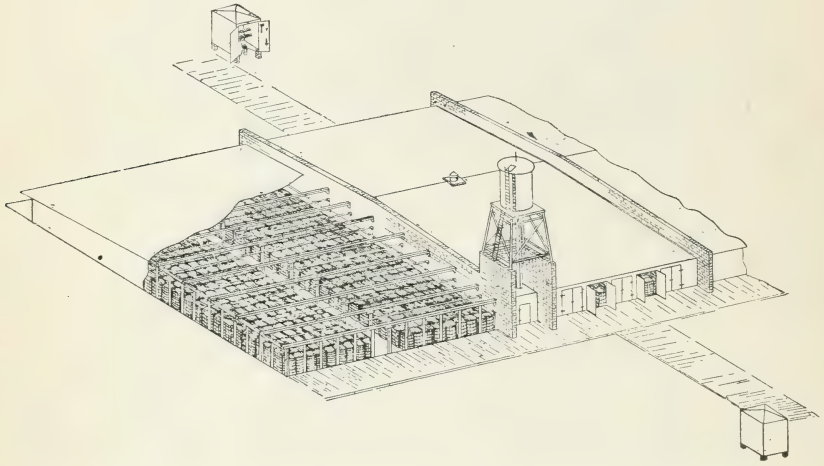


FIG. 12.—Standard cotton warehouse fully protected, showing the proper method of storing.

buildings of different heights are given below. In the table the thickness refers to the outside walls. In all cases the division walls between the storage compartments should be 4 inches thicker than outside walls.

Standard fire walls.

Height of building.	Thickness of outside walls, in inches.					
	First story.	Second story.	Third story.	Fourth story.	Fifth story.	Sixth story.
One story	13					
Two stories	17	13				
Three stories	17	17	13			
Four stories	22	17	17	13		
Five stories	22	22	17	17	13	
Six stories	26	22	22	17	17	13

FLOORS.

All of the standards recommended by the insurance companies require that floors be of concrete, dirt, shell, or other incombustible material. Many warehousemen object to any of these floors for the reason that when cotton is stored on such floors for any length of time "country damage" usually occurs. This is undoubtedly true

in the case of dirt floors unless drainage is unusually good. Many of the best warehouses, however, have dirt floors. If the drainage is good, the cotton will not be damaged when stored temporarily. When it is to be stored for any length of time, it should be placed on timbers that will keep it well off the ground. Most warehouses keep a supply of skids or stringers, 6 by 8 inches or 4 by 6 inches. These timbers keep the cotton well off the ground, and there is no danger from damage from too much moisture. The great advantage of the dirt floor is the saving in cost of building and insurance. The dirt floor does not require such high walls as are required where a plank or concrete floor is used, and the cost of a standard floor such as cement or brick is very high. The insurance rate is 25 cents higher on plank floors.

Concrete.—There is a wide difference in opinion among warehousemen on the advisability of using concrete as a floor. In the first place, there is the very high cost. In the second place, it is contended that cotton will be damaged when stored in contact with such a floor. Others are highly in favor of using it and do not think that the cotton damages to any appreciable extent. It seems safe, however, to state that there is some danger unless there is perfect underdrainage. If a suitable space under the floor is built up with coarse, clean sand, as required by the standards, and a proper outlet is maintained for any water, it seems that damage from this source is almost negligible. If, however, the drainage is not sufficient, there will certainly be some damage. This is especially true if the cotton is too damp when stored. It is also claimed that cotton will lose weight when in contact with a concrete floor during excessively dry seasons.

Paving blocks.—Some warehousemen are now advocating the use of wooden paving blocks for flooring. This material is not included in the present standards of the underwriters' associations, but there seems to be no good reason why it should not be classed as fully standard. A floor made of this material would last indefinitely, and there would be apparently no danger of damage from excessive moisture nor loss from undue drying. The suggestion is certainly worth consideration by any who are preparing to build. The cost, however, would be rather high.

If for any reason a standard floor is not built, the owner should be very careful to have a good, substantial wooden floor. In the first place, substantial pillars of brick or other strong material should be used, and they should be placed often enough to make a strong foundation for the floor. Sleepers should be of the best material, not less than 6 by 8 inches in diameter. The flooring should be not less than 2 inches in thickness and should be splined or tongued and

grooved. To get the best insurance rate, the space from the floor to the ground should be filled in with some noncombustible material. If this is not done it is essential that there should be no openings from this space to the outside of the building.

AUTOMATIC SPRINKLERS.

While it is not possible to give specifications for a system of automatic sprinklers, the installation of such systems in all cotton warehouses is urged. To do so means additional cost, but the saving in insurance will more than offset this cost of installation. The expenditure is fully justified by the protection given the cotton, which results in saving in the cost of insurance. Numerous warehouses have been found where the insurance rate has been reduced from $1.50 per hundred dollars to 30 cents. Many companies are now selling and installing these systems. Before anyone purchases he should have detailed specifications prepared, and these should be submitted to the underwriters having jurisdiction. The importance of this can hardly be overestimated. An owner of a warehouse recently had a sprinkler system installed in his warehouse, expecting to get the usual reduction in insurance rate. However, it developed that the capacity of his tank was only 3,000 gallons, while the requirements called for a minimum capacity of 25,000 gallons.

History.—In connection with the discussion of the automatic sprinkler as a means of controlling fires, it is interesting to note the development of this system. Formerly there were many fires in cotton mills, especially in picker rooms, in which department much loose cotton is handled. Disastrous fires frequently start in the picker itself. This machine has spikes on a cylinder which tear or loosen the cotton. When one of these spikes becomes slightly bent, it may touch another spike on the machine, and the resulting spark usually starts a fire. For a long time there was no protection against such fires except the casks of water and pails. Finally it became customary to provide this room with a crude sprinkler system. This consisted of numerous perforated pipes throughout the room. These pipes were connected with a supply of water. A valve on the outside of the building was designed to turn the water into the perforated pipes. Under this arrangement when a fire started some employee went out to the valve and turned on the water. This apparatus was a great improvement over the old condition, but it was weak in several respects. In the first place, the water was not turned on until some one went from the scene of the fire and opened the valve. Another very serious objection was that the water was applied to all portions of the room. This damaged the building, machinery, and cotton in places where it was not necessary, besides exhausting the water supply unnecessarily.

Description of a modern automatic sprinkler system.—The direct outgrowth of this crude arrangement was the present automatic sprinkler system. This system consists of a tank or other means of supplying water. Ordinarily it is a large gravity tank and has direct connection with at least one city main. Pipes connecting with this main are in all portions of the building. The water is distributed by sprinkler heads. These heads are so arranged that when they are heated to a certain degree they open and send out a considerable stream or spray of water Under good pressure one head will discharge some 40 or 50 gallons of water per minute. This system has two very important advantages over the earlier form. The water is liberated automatically—that is, when a fire starts the heat opens the heads and the water is turned on without the attention of any person. A second advantage is that only those heads near the fire are opened. This prevents damage to wares in other portions of the compartment and also conserves the water except for the particular space where the fire is burning.

The automatic sprinkler system in its latest development consists of a tank or other water supply of ample capacity—depending upon the amount of space protected by the system—proper connections with the city mains or other sources of water, sprinkler heads distributed over the building with the necessary water supply pipes, and an alarm which is set off automatically when a fire starts. If a dry-pipe system is used, in order to prevent freezing of the water in the pipe, the system requires draining after a fire, and the dry-pipe valve is then reset. The water pressure at the heads should be at least 15 pounds, which makes it necessary for the tank to be at least 30 feet above the highest head. A dry valve is not always used, except where there is danger that water will freeze in the pipes, and thus render the system worthless at a time when it might be needed. When it is possible, the system should have at least a 6-inch connection with the city main. The sprinkler heads should be distributed over the building in such a way that one head would cover a space of 65 to 90 square feet, depending upon the arrangement and construction of the building. These heads should be placed near the ceiling. If a fire occurs near the floor, the heat rises immediately, and the heads directly over the fire are opened automatically. It requires 155° to 165° F. to melt the solder and automatically release the water.

A fully protected warehouse which conforms in every respect to the requirements of the underwriters' association is shown in figure 13. When cotton is valued at 10 cents per pound, or $50 per bale, it is possible to insure it in this warehouse at the rate of 5 cents per bale per annum. This illustrates forcibly the advantage to be gained by conforming to the underwriters' standards and installing approved

automatic sprinkler equipment, which effects a great saving in the cost of insurance.

FENCES AROUND WAREHOUSES AND COTTON YARDS.

It is very important that cotton stored in open sheds or yards should be fenced in. Such a fence should be made of good boards, securely nailed to railings, which are in turn fastened to strong posts. In other words, it should be a good, close, substantial board fence at least 6 feet in height. These fences prevent prowling, the careless throwing of cigarette stubs, and various other practices that frequently prove costly. It is usually possible to reduce insurance rates materially by taking this precaution. While it is not at all

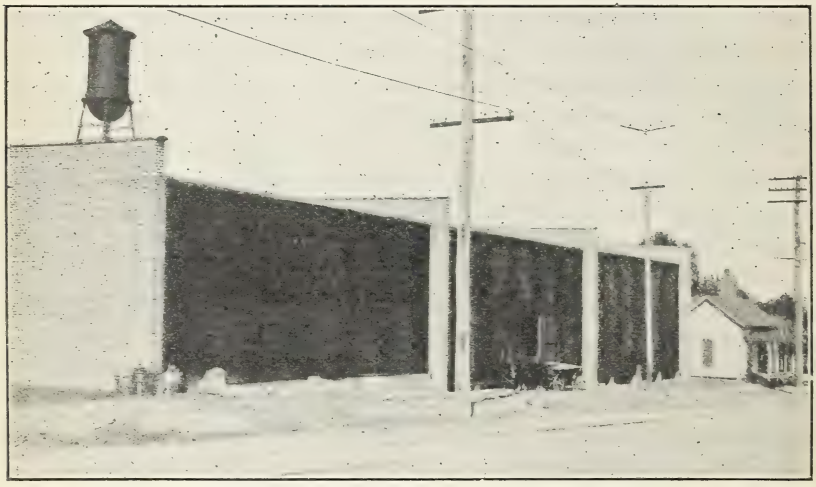


FIG. 13.—A standard two-story cotton warehouse.

essential, it would be well for such a fence to be erected around all warehouses, together with the adjacent yards that are used for handling cotton.

A wire fence should never be placed around yards or sheds, for it interferes with handling cotton during a fire, and consequently increases insurance rates.

FINANCIAL CONNECTION.

When the construction of a warehouse is being contemplated, it is well to take into consideration the financial assistance that probably will be extended by the banks to those who store cotton. It is frequently the case that owners store cotton primarily for the purpose of obtaining money for use until the conditions of the market are improved. If it were possible to obtain money on the best terms, much cotton would be stored which at present is allowed to damage and remain unprotected from fire and theft. Many companies get

comparatively little business and eventually fail because the banks are not willing to advance money on cotton stored with them. This should certainly be taken into consideration when preparing to build a warehouse. If satisfactory financial connections can not be arranged, the chances are that the undertaking will prove a disappointment and the promoters will necessarily lose by making such an investment.

COOPERATION OF FARMERS.

Other investigations [1] have shown conclusively that most of the small warehouses located near the points of production do not pay for the operating expenses and deterioration of the property. For this reason very few companies in the small towns are inclined to operate warehouses that give adequate service. If the farmers in such a community wish to be assured of storage service at all times, they should form cooperative associations and build their own storage houses. In most cases such associations would not be expected to pay any dividends, but the farmers would be sure that they would have available storage space at all times, and in this way they would be independent of factors, merchants, and others who now control most of the storage space. If the farmers in such communities would go further and organize selling associations, it would be possible to employ an experienced cotton man who would be able to market the cotton more profitably than is now done. The cotton mills are saving considerable sums of money by cooperation in insurance. The mutual companies insure cotton belonging to mills for much less than it is necessary to pay when cotton is stored in a public warehouse. There is no reason why farmers should not save by cooperating in building and insuring their own cotton warehouses.

CONCLUSION.

An adequate system of storage houses is one of the most imperative needs of the South. Such an improvement would bring about an annual saving of millions of dollars from what is usually called "country damage." This change would also eventually bring about many reforms in the present method of marketing cotton. In addition to cotton, the South annually handles products worth hundreds of millions of dollars that would be stored if it were possible to do so under favorable conditions. There is also a great demand for storage space for merchandise and various manufactured products, such as fertilizers and farm machinery.

In concluding this discussion of the construction of warehouses, it is urged again that it is of the greatest importance that warehouses

[1] Nixon, Robert L. Cotton Warehouses: Storage Facilities now Available in the South. Bulletin 216, U. S. Department of Agriculture. 1915.

conform to the standards of the underwriters' association. These standards have been worked out very carefully and represent the best thought in protecting cotton from both fire and weather at a minimum cost. Many millions of dollars have been spent unwisely in the construction of warehouses that do not conform to these standards. A thorough survey made by this office shows conclusively that many of these houses cost more to build than they would if they had been made to conform to the recognized standards. Most warehouses, as they are now constructed, are not only subject to unnecessarily high insurance rates, but are usually costlier than those conforming to the standards, and the cost of handling cotton stored in them is unnecessarily high.

The diagrams in this bulletin should not be treated as plans for building. An attempt has been made to outline some of the essential features of each type. It is very important that a competent architect draw up specifications for any warehouse. While it will be necessary to pay a fee for this service, the plans will save a great deal in the cost of construction and insurance and add much to the value of the storage house by making it possible to handle cotton more economically. It is also important to have warehouses properly located. This is frequently the determining factor between success and failure. Many warehouses erected by cooperative organizations and by others have been so located that they are not available to a large majority of the people who frequently wish to store cotton. This has resulted in the failure of many such enterprises. Farmers should form cooperative organizations for building better storage houses where adequate facilities are not available on favorable terms.

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